

# For a Cleaner World

TRANSFORMING YOUR  
WASTE  
INTO RAW MATERIALS



“For a cleaner world” was the first motivation to found Pyrum Innovations in 2007, with the clear ambition to develop breakthrough solutions to recycle / recover, into valuable raw materials, almost any kind of polymer waste, by a process called Thermolysis



## Creating new products out of your waste

Thermolysis can transform end of life rubber, bitumen and plastic waste into oil, coke and gas.

Thermolysis is a thermo-chemical decomposition of material at high temperatures without the presence of oxygen. Through this process, any kind of polymer is decomposed into basic constituents, which can be easily split for a better recovering.

Recycling rubber, bitumen and plastic is a huge issue for today and tomorrow's society. For the moment, most of this waste is just burnt or buried. This way of

doing creates huge CO<sub>2</sub> emissions. Nobody, until now, saw the real potential of rubber. Pyrum Innovations is able to fuel your car, light your home or create new products thanks to old rubber, plastic, or bitumen. In other words, it is possible to get quality oil, coke, and gas out of old waste. Thermolysis is not a new concept. It was just essential to rethink the whole process in order to come to an efficient and profitable system.

The used polymer market is a hot spot for today's whole world. Most of the time manufacturers have the obligation to recycle their waste. Since a few years, some manufacturers have also been pushed by local governments to recycle their production waste in an environmental friendly way. Up to now, the most attractive way of “recycling” has

been to simply burn everything. Some firms are currently also granulating their waste before using them for land filling purposes. The demand for a clean recycling process that also produces new high quality raw materials is arising and will offer opportunities for Pyrum to expand its technology. Everybody is now asked to sort its households' waste. But still, no real solution is given after this point. The consumer is always more demanding about environmental friendly products and their recycling processes.

Pyrum unique thermolysis process can combine rubber recycling with high profits and environment protection. The company's prototype and industrial unit (respective yearly recycling capacity of 360tons and 5,000tons) is the proof of a well functioning process that has also been patented.

## Tomorrow's recycling



Co-funded by the Eco-innovation Initiative of the European Union

“The long-term goal is for the world to become a recycling society, that seeks to avoid waste and uses waste as a resource“

(European Commission Communication “Taking sustainable use of resources forward”)



## Why Pyrum Innovations®?

-  **100%** autonomous system
-  **95%** CO<sub>2</sub> savings
-  Flexible **modul construction**
-  **Waste** is transformed into raw materials
-  Oil production price: **0,10 €/l**
-  Profit margin: **> 20%**

## What is Thermolysis ?

The Pyrum recycling process is characterized by an indirect heat transfer system of electrically heated resistances that are acting on granulates placed in a vertical reactor, which is under oxygen exclusion. At a temperature between 500 and 850 °C, the hydrocarbon compounds are decomposed and rebuilt in a succession of short-chain compounds.

As a result, the final products are divided into solids (coke, carbon black, fillers), liquids (thermolysis oil from different densities and compositions), and gas. The temperature profile within the reactor is very important: it gives the possibility to change the specific composition of the thermolysis vapors and the thermolysis coke.

## Thermolysis, an old technique that never worked before

It has been more than forty years that companies are trying to find a way to recycle plastic, bitumen and rubber waste in an effective way. Pyrum Innovations is the revolution that will dramatically change the mechanics and economics of the recycling society all over the world.

Thermolysis is often presented as an old technique, extensively researched, and never developed on industrial sizes. The surely most known projects are based on rotating kilns or batches. All of them had three major problems: heat transfer disturbances, no hermetic atmosphere due to moving parts, and lack of profitability due to low value of the raw materials produced. If thermolysis is not done at good heat levels, the products will not be from a good quality: wet coke, thick and non usable oil.

Pyrum Innovations' unique Thermolysis process can combine rubber recycling with high profits and environment protection.

## Pyrum Innovations, the recipe that made thermolysis efficient and profitable

The most important part of the machine is the patented vertical reactor. This aggregate allows to have full control of the thermal energy. As the heat is made by electric heating elements, Pyrum has complete control over the heat while emitting no CO<sub>2</sub> during the retreatment. This means that if one kind of waste requires a temperature of 555 °C to create the specific raw material needed, it is possible to do it.

Pyrum's thermolysis process can operate on a wide range of temperature. This competence is more than important, because it allows us to create the right atmosphere in order to produce the oil we need. This allows us also to have a completely finished thermolysis that ensures clean, stable and marketable raw materials.

By designing a vertical reactor, Pyrum Innovations is using gravity for its process. Thanks to that, we do not need moving parts in order to forward the products. As there are no moving parts, there are no sealing problems. The whole process can be kept hermetic.

Another aspect of the technology is that it is fully automatic. There is no need for human workforce for the process to run. A combination of over 200 different sensors and especially developed softwares makes it possible for the plant to run at its own.

## Why Thermolysis ?

An environmental friendly and profitable answer to a global problem

### 1. 100% autonomous system

The gas produced is transformed into electricity thanks to our custom-made MAN 12-cylinders engines. The engines produce enough power to fuel the whole thermolysis plant. No need for external energy for the thermolysis unit

### 2. 95% CO<sub>2</sub> savings

Burning 1 ton of rubber produces up to 2.6 tons of CO<sub>2</sub>. The Therm4rec system enables to drastically reduce those emissions

### 3. Flexible modul construction

The Therm4rec process has been designed in order to easily enhance the recycling capacities

### 4. Waste transformed into raw material

The thermolysis process is able to design the type of oil each customer is willing to get. There is no big deal to design the raw materials a manufacturer is needing

## No CO<sub>2</sub> emissions

The thermolysis process itself is free of any kind of emission. As we are working with a closed and well-sealed process, nothing can escape the reactor. The only CO<sub>2</sub> emissions we are generating is the one issuing from the optional gas generator that is converting the self-produced gas into energy in order to get the process autonomous.

## How does it work?

Innovation consists in producing and exploiting with success a new process – Pyrum did it



### Step 1: Collection

The process is able to retreat rubber, bitumen and plastic waste

### Step 2: Fragmentation of the waste

Each type of waste needs to be granulated into small pieces for our process needs (1–12mm)

### Step 3: Thermolysis

Shock-heating of the granulates in order to avoid clogs

Vaporization of the oil

Creation of coke

### Step 4: Management of the newly created products

Condensation of the vaporized oil

Separation of the gas

Cool-down of the coke

### Step 5: Energy creation

Creation of energy through gas generators

Creation of thermal energy

### Step 6: Improvement of the products created through the process

Insertion in production recipes in order to produce new goods

Production of activated charcoal

Production of carbon black

Distillation of the oil to get fuel

## Up to 95% Oil

Depending on the waste type, it is possible to regain up to 95% Oil.

The average percentage for rubber is 50% – for bitumen products, 25%

## Enhanced profitability for manufacturers and recyclers

Around 50 % of our production are oil derivatives. Nowadays, the oil price is slowly rising to climaxes. Each day, more people are demanding oil. As rubber is made out of different oil combinations, Pyrum's goal is to regain them in order to enlarge the oil offer. The companies working in our consortium are able to take back the oil that is inside their waste in order to reuse them for new types of products.

The produced coke can be used as filler in a rubber mixture. It can also be enhanced to create filters (activated coke), carbon black (for the color industry), fertilizer, etc.

Nowadays, the manufacturers' recycling costs are very high. For example, an EPDM manufacturer has to pay up to 120 €/ton in order to get rid of its waste. The fact is that most of today's recycling processes are not very profitable. In other words, the reselling of their final goods is not lucrative enough in order to be economically sustainable. That is why the gate fees are so high.

Pyrum Innovations' process is able to provide goods that are much more profitable. The oil we provide is fluctuating like the regular oil price. Moreover, our oil is much cleaner than the oil we can find in barrels: there is no water, no sulfur, and no minerals. Pyrum Innovations' oil just needs to be distilled.

## A perpetual cycle

The good thing about this process is that it can go perpetual. In fact, production waste can be retreated, and then transformed into raw materials that are mixed within new rubber products. Those products can once be recycled a second time, then a third time, aso. This virtuous circle can then become perpetual. This way of working would reduce the emission of harming chemicals that are endangering our day-to-day life. Using production waste to create new products from the same type was always a big concern. Thanks to the thermolysis process, we are able to help local companies to reduce their costs while keeping the planet clean.

## No limits for recycling

As simple as it can sound, there are few market barriers for the thermolysis process. Most of the rubber, bitumen, and plastic waste can be recycled thanks to this method. Most of the polymers are still a problem when it comes to recycling. In order to get rid of them in a very easy manner, companies are burning or burying them. The pollution that comes from these practices is huge: the air, the earth and the water are sacrificed. Pyrum Innovations is presenting something much more effective than the current methods. We are presenting a world where waste is the fuel and the raw material for new products.

Thermolysis,  
the recycling of  
tomorrow

Environmental friendly

Reduce CO<sub>2</sub> emissions

Waste to oil

Create new goods

Energy generating

High profitability

Thermolysis,  
recycle almost all waste

Rubber Waste

Bitumen Waste

Plastic Waste

Biomass

Oil shale / Oil Sand



## The industrial unit

Pyrum Innovations created a standardized industrial recycling module in Germany. This plant has the ability to transform 5,000 tons of rubber per year into 2,500 tons of oil, 1900 tons of coke and 600 tons of gas. It is following the strict German law for environment protection (BImSchG).

The unit is designed to work 7,800 hours a year (24/7) with an operating temperature of 500°C to 850°C.

This 26 meters high tower is designed to be installed everywhere, all around the world. It has been conceived in a very

effective manner that helps to minimize space on the ground.

The unit is completely automated. Only two to three workforce per shift is needed to run the installation. The automation system has been specially developed for Pyrum's process.

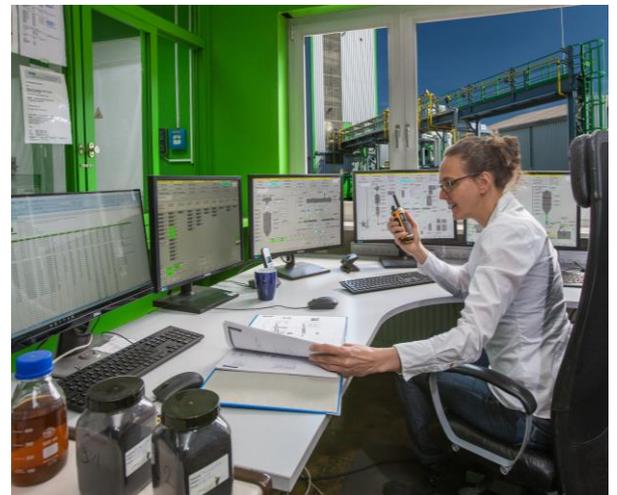
The module can easily be fine-tuned in order to accept different kinds of waste types. There will be a solution for a huge range of waste types.

In one year, a 5,000 tons Therm4rec unit will emit only 5 tons of CO<sub>2</sub>. Burning the same amount of rubber in a regular atmosphere would produce up to 13,000 tons.

Where can you find us ?



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### Partner Companies:



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